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NEW SPECIES OF CICADAS FROM CALIFORNIA AND UTAH.

BY WM. T. DAVIS,

NEW BRIGHTON, STATEN ISLAND, N. Y.

In preparing his Preliminary Review of the West Coast Cicadidæ, printed elsewhere in this JOURNAL, Mr. Edward P. Van Duzee examined a number of specimens from my collection and has very kindly suggested that I describe some of the new species. He has also been good enough to place in my hands some of the specimens described in the above mentioned paper, so that I might have them for comparison.

It is evident that there are a considerable number of species of cicadas in the states bordering the Pacific ocean many of which may best be treated of by comparison with *Okanagana rimosa* and *Okanagana synodica* described many years ago by Thomas Say from the middle west. Say's description of *synodica* is particularly good and the species has been easily identified from the Rocky Mountain region of Colorado, where it is quite abundant. Following this plan the descriptions here given often make reference and comparison to these two standard species.

Okanagana rubrovenosa new species.

Type male, Mariposa Co., California, June 15, 1914.

A little smaller than *O. rimosa*, slimmer and with proportionately narrower fore wings; color black and dark sanguineous. A strikingly handsome species.

Length 22 mm.; to tip of the wings 31 mm.; fore wing 8.5 by 26 mm. Head as wide as the anterior portion of the pronotum, front about as prominent as in *rimosa*; surface of the head between the eyes not deeply furrowed. Front convex, the median sulcus somewhat narrowed above, transverse rugæ about as prominent as in *rimosa*. Pronotum 3.5 by 8 mm., the sides parallel, or nearly so anteriorly; humeral angles shaped as in *rimosa*, with the wrinkles less prominent. Opercula oblique, sides sinuated. Last ventral seg-

ment long with the sides from about the middle nearly parallel to the truncated end. Valve of the male long, about as in *rimosa*. Uncus hooked at the end but not suddenly. Fore wings with the basal cell narrower than in *rimosa*. The dorsum in this species is black, but has a dull reddish appearance owing to its covering of rufus hairs. There is a dark red, narrow, broken line on the head just above the antennæ, and the hind margins of the pronotum, mesonotum and metanotum are also dark red. The X in the type is black, but in two of the paratypes it is dorsally touched with dark red. The mid-dorsal spots so general on the mesonotum of species of *Okanagana* are absent. Beneath nearly all black with a patch of silvery hairs each side at the base of the wings. The front is narrowly lined with dark red about the transverse rugæ. Fore femora black striped with dark red; the middle and hind femora and tibiæ more red than the anterior pair. Opercula edged with red, also the posterior margin of each abdominal segment. Uncus black, especially above; valve black on lower surface with the upper edge red. The red markings on the body are not at all conspicuous. Venation of all of the wings nearly uniform sanguineous, darkened and more spread out over the cells at base.

In addition to the type there are three paratypic males in the author's collection, all collected at the same time and place by Mr. Nunenmacher, and a small male from Napa Co., California, is in the collection of the American Museum of Natural History.

Okanagana mariposa new species.

Type male, Mariposa Co., California, June 16, 1914.

Larger than *rimosa* with rather narrow wings; largely black in color and decorated with orange.

Length 29 mm.; to tip of the wings 42 mm., fore wing 8 by 35 mm. Head as wide as the anterior portion of the pronotum; front about as prominent as in *rimosa*; top of head lacking the furrow present in *rimosa* on each side leading from the posterior ocellus toward the eye. Front convex, the median sulcus narrowed above, transverse rugæ about as prominent as in *rimosa*. Pronotum 5.5 by 11 mm., the sides anteriorly not quite parallel and edged with irregularly set teeth. (These might be reduced to sinuations in some specimens.) Humeral angles shaped as in *rimosa* with the wrinkles

about as prominent. Opercula oblique with the inner, lower angle not much produced. Valve 5 mm. in length. Uncus not hooked at the end, but very slightly narrowed, truncated and the end shallowly notched, thus different in shape from *rimosa* and No. 19 described in Mr. Van Duzee's paper referred to above. Venation and color of the wings about as in *rimosa* except that the bright or reddish orange is replaced by duller tints at the base of all of the wings, and the costa is greenish yellow. The dorsum of this species is nearly all black. The supra-antennal plates are touched with orange; the pronotum is narrowly edged with dull orange except on the anterior margin, and a very faint mid-dorsal streak of the same color extends to the outer edge from about its central portion. The mesonotum has the top of the X touched with pale orange and the four spots in front of the X are arranged in a semi-circle. The sides of the mesonotum are ornamented with orange at the base of the wings, two pale spots being particularly conspicuous. The posterior part of the metanotum is edged with orange. The dorsum of the abdomen has the posterior edge of the first and last segments narrowly streaked with greenish orange; the lower edge of the supra-anal plate and the upper edge of the valve are greenish orange; the uncus is black. The valve is greenish beneath and the lower surface of each abdominal segment is black edged on posterior margin and sides with light orange. The legs are orange streaked and spotted with black about as in *rimosa*, except that there is more black particularly on the fore femora.

The shape of the fore wings in *mariposa* is different from that of any other species of the genus I have seen in that the outer margin is not so evenly curved, but forms more of a straight line to the tip of the wing.

Okanagana hirsuta new species.

Type, female, Santa Rosa Island off the coast of southern California.

A hairy species, with particularly long hairs on under side and on the legs.

Length 25 mm.; to tip of the wings 37 mm.; fore wings 7 by 31 mm. Head nearly as wide as the anterior margin of the pronotum; front about as prominent as in *rimosa*; median sulcus narrow with parallel sides. Pronotum 4.5 by 10.5 mm., the sides anteriorly not

quite parallel and somewhat sinuated; humeral angles rounded; anterior angles prominent. Last ventral segment with the notch about half as deep as the segment is long and broadly V-shaped. The venation is the same as in *mariposa*, but the basal areole is clear instead of fuscous as in that species, *rimosa*, *vanduzeei*, etc. The costa is greenish yellow edged in part with black. There is the usual fuscous and orange colors at the base of all of the wings and the flaps are bright orange, on the hind wings clouded with fuscous. The dorsum of this species is black variegated with bright orange. Head black with the supra-antennal plates touched with orange; the pronotum is very narrowly edged with orange anteriorly and with a little broader band on the posterior margin and humeral angles; the slightly sinuated sides are black. The mesonotum has the orange spot on the top of the X divided by a black line and the four spots in front of the X are arranged in a semi-circle. The posterior margin is narrowly bordered with orange, and there are two orange spots at the base of each fore wing. The posterior part of the metanotum is edged with orange. The dorsum of the abdomen has all of the segments, except the basal one, narrowly edged on their hind margins with bright orange, the stripes being about obliterated along the median line. On the second segment the stripe is broader than on the others, but is absent dorsally. Beneath, the abdominal segments are black edged posteriorly with bright orange. All of the femora are striped with orange and black. The lower surface is thickly clothed with very long, light colored hairs, which are to be found even on the legs out to the tarsi; on the hind tibiae they are about twice as long as its diameter. When viewed from above the hairs from the lower surface are seen to form a fringe about the body.

The female type in the collection of the American Museum of Natural History is the only specimen seen by the writer.

Okanagana triangulata new species.

Type male, Mendocino Co., California, May 10, 1910.

The triangular or obconical black area at the base of the abdomen is a conspicuous character of this insect. Length 21 mm.; to tip of the wings 25 mm.; fore wing 8 by 20 mm. Head small and narrower than the front margin of the prothorax; the front produced and a little blunter than in *synodica*; the supra-antennal plates with outer

edge nearly rounded, and the sulcus extending from the central oculus backward to the posterior margins quite deep. The median sulcus on the front rather shallow and almost obliterated at its upper end; transverse rugæ as in *synodica*. Pronotum 3.5 by 8 mm., the sides not parallel but converging toward the eyes as in *synodica*, the humeral angles rounded, beyond a rather deep sinus extending about one half of the distance toward the anterior angles which are prominent and not so much bent downward as in *synodica*. Opercula oblique, sides sinuated. Last ventral segment with the base a little longer than the sides which converge to the truncated tip. Valve of the male broader and proportionately shorter than in *synodica*. Uncus viewed in profile not hooked but with a sinuation near the tip not present in *synodica*; when viewed from above, produced into two points with a considerable intervening notch, instead of being truncated with a shallow sinuation as in *synodica*. Fore wings with the basal areole narrowed to an obliquely rounded apex; both pairs of wings suffused at the base with testaceous; fore and hind flaps ornamented with bright orange. Veins of the fore wings testaceous, not fuscous beyond the middle as in *synodica*. The dorsum of this species is black and yellow sparsely covered with golden hairs. Head above with the elevations black except an extended spot of black on each supra-antennal plate; depressions pale. Pronotum except the anterior angles margined with pale particularly broad on the hind margin; the elevations mostly black, the pale color extending irregularly upward from the grooves on to the sides. Mesonotum black, edged behind and to the fore wings with orange; X black at center, edged with orange; four pale spots in front of the X arranged in a semicircle, and at the tip of each anterior line of the X there is a conspicuous, light yellow, impressed puncture. From the base of each fore wing there extends an oblong spot having a clouded central area. Metanotum with posterior edge dull orange. Dorsum of the abdomen with a basal obconical black area with the hind margin of each segment yellow and on the sides two rows of spots more or less incomplete. The last segment is all yellow with indications of two basal spots. Supra-anal plate not as deeply notched at the end as in *synodica*, black above edged with yellow below; uncus yellow. Beneath, the valve, also the abdominal segments entirely yellow.

except a conspicuous black line on the posterior margin of the first segment. Legs yellow, streaked and spotted with black.

The type was collected by Mr. Nunenmacher. In the collection of the American Museum of Natural History there is a female from Angel Island, California, that probably belongs to this species, though the basal areole of the elytra is not so narrowed to a rounded apex as in the male type. However, otherwise it appears to be the same. The last ventral segment has a broad V-shaped notch extending about half of the way to its base.

Okanagana mercedita new species.

Type male, Merced Co., California, June 18, 1914.

Length 19 mm.; to the tip of the wings 21 mm.; fore wing 6.5 by 17 mm. Head about as broad as the front margin of the pronotum, the front produced nearly as in *synodica*; supra-antennal plates with outer edge rounded. The median sulcus on the front rather broad, with the sides sinuated. Pronotum 3 by 7.5 mm., the sides not parallel, the humeral angles rounded and the anterior angles bent downward. Opercula oblique, sides sinuated. Last ventral segment with the base longer than the sides which converge to the rounded end. Valve is long as in *synodica* (5 mm.). Uncus when viewed in profile, hooked; when viewed from above narrowed toward the deeply notched apex. Fore wings with the basal areole oblong and square at apex; both pairs of wings more transparent than in *synodica* and *triangulata*, with the veins commencing at the transverse fold infuscated. Costa of the fore wings yellowish; all of the wings fuscous and bright orange at base; flaps bright orange. The dorsum of this species is blackish sparingly covered with light colored appressed hairs. Head above black with a light colored band in front of the anterior ocellus and extending on to the supra-antennal plates where there is an enclosed black spot over each antenna; a light spot on the median sulcus extends to the posterior margin. Pronotum with the central portion black except some of the grooves, and irregularly margined with pale except the hind margin which is more definitely banded. Mesonotum black with two light colored streaks on the anterior part being the exterior lines of the often present W-mark of some species; below these the X, which is light colored and joins on to the light colored band encircling the posterior

part of the mesonotum. At the tip of each anterior line of the X there is a black impressed puncture. Metanotum with posterior edge greenish yellow. Dorsum of the abdomen black with the segments narrowly edged with yellow except the last segment which is yellowish with a large irregular spot dorsally and a faint, narrow one each side. In the dorsal spot there are indications of two small included light spots at the base of the segment. Supra-anal plate dorsally black with the sides yellow. Uncus yellow shaded with brown, particularly at the tip. Beneath, the valve yellow, also the posterior margins of the abdominal segments, the last one having the entire central area yellow. Each ventral segment has two dark spots, one on each side of the central area. The opercula yellow touched with orange and black. Legs yellow streaked and spotted with black.

A paratypic female has the hind margin of the last ventral segment deeply notched almost to the base; the segment is pale with a black spot on either side; otherwise the female is colored as in the male.

In addition to the type and the female mentioned above, there are in the author's collection 16 males and 14 females, all from Merced Co., California. This series shows the transverse fold crossing the fore wings at the node, often considerably developed and in this respect approaching the much larger *Tibicinoides hesperius*, which it also resembles in color and markings more than it does *synodica*. Further the uncus is shaped much more like that of *hesperius* than *synodica*, the head, however, in form is more like the latter species. The outer row of cells in the fore wing are proportionately short in *mercedita*, whereas they are long in *hesperius* and *synodica*. The front in *hesperius* is usually margined on the upper surface by a well-defined elevated ridge.

Okanagana minuta new species.

Type from Stanford University, California, May 26, 1914.

The smallest *Okanagana* so far described.

Length 16 mm.; to the tip of the wings 18 mm.; fore wings 5.5 by 15 mm. Head not quite as broad as the front margin of the pronotum; the front produced as in *synodica*; supra-antennal plates anteriorly not much rounded. Median sulcus of the front broad. Pronotum 2.5 by 6 mm., the sides not parallel, the humeral angles

rounded and the anterior angles rather prominent. Opercula oblique with the apex turned inward as in *synodica*. Last ventral segment with the base longer than the sides which gradually converge to the rounded end. Valve 3.5 mm. in length. Uncus when viewed in profile hooked; when viewed from above narrowed toward the deeply notched apex. Fore wing with the basal areole oblong and square at apex; both pairs of wings more transparent than in *synodica*, with the veins commencing at the transverse fold infuscated. Costa of the fore wings yellowish; all of the wings fuscous and bridge orange at base; flaps bright orange. The dorsum of this species is blackish, covered with light-colored appressed hairs. Head above black with an irregular pale band before the eyes and a yellowish spot on each supra-antennal plate; a light spot on the median sulcus extends to the posterior margin. Pronotum with the central portion black with the yellow color of the grooves extending well upward; margined with yellow, that of the hind margin being particularly definite. Mesonotum black with the W-mark on the anterior part represented by its two outer lines, below these the X, which is black touched on the apex with pale; hind margin around to the wings, yellowish. At the tip of each anterior line of the X there is a conspicuous black impressed puncture surrounded by golden hairs. Metanotum with posterior edge greenish yellow. Dorsum of the abdomen black with all of the segments edged with yellow. Supra-anal plate dorsally black with the sides yellow. Uncus nearly black. Beneath, the valve pale, also the posterior margins of the abdominal segments, the last one being about one half pale. The opercula black broadly edged with pale.

In addition to the type I have examined 11 paratype males all from the same place as the type and from Mr. Clarence H. Kennedy. Mr. Van Duzee has also sent to me a female from Fresno Co., Cal. (J. C. Bradley, Collector), that probably belongs to this species and which has the deep notch in the last ventral segment broadly U-shaped, instead of V-shaped as in *mercedita*. *Okanagana minuta* in some respects closely resembles *O. mercedita*, especially when large individuals of the one species are compared with small examples of the other, but when viewed in series the head of *minuta* is seen to be proportionately much smaller than that of *mercedita*. Thus in a large *minuta* and a small *mercedita*, each expanding about 38 mm.,

the head of the former measured across the eyes is 4.5 mm., and that of the latter is 5.5 mm.

Okanagana schaefferi new species.

Type, male, Bucks Valley, Iron Co., Utah.

A large insect with very prominent front, larger than either *O. rimosa* or *O. vanduzeei*, but with the wings shaped as in those species. The colors and markings resemble those of *vanduzeei*.

Length 28 mm.; to the tip of the wings 38 mm.; fore wing 12 by 32 mm. Head not quite as broad as the front margin of the pronotum; front strongly produced, and the upper surface with a not very sharply defined broad elevated margin; front sulcus narrow. Pronotum 5 by 11 mm.; the humeral angles rounded and the sides evenly narrowed toward the anterior angles which are rounded. Opercula oblique with the ends not much turned inward. Last ventral segment with the base about as long as the sides which gradually converge to the truncated end which is slightly sinuated. Valve 4 mm. in length. Uncus when viewed in profile short, stout not hooked; when viewed from above, broad, widest in the middle, with the end truncate. Wings rather broad, transparent, and with the venation as in *rimosa* and *vanduzeei*. Costa of the fore wings yellowish. All of the wings fuscous and orange at the base; flaps orange, those of the hind wings a little fuscous. Head above black with a light spot on the edge of each supra-antennal plate. Pronotum black edged all round with orange and about one half of the median groove yellow. Mesonotum black with hind margin irregularly bordered with light orange; X orange, with a black central line and a black band across each anterior ridge followed by orange. Two very small orange spots beyond. A yellow dash near the base of each fore wing. Metanotum with the posterior edge light orange. Dorsum of the abdomen black with all but the basal segment posteriorly edged with orange; uncus black. Beneath, the valve pale orange; hind margins of all of the segments orange, except the last which is more than one half pale orange. The opercula black with the hind margins orange. Fore femora all black except the distal tips which are orange. Middle and hind femora black except the orange colored distal tips and inner surface. Rostrum black, orange at base, head black beneath, except the small orange spots about each antenna.

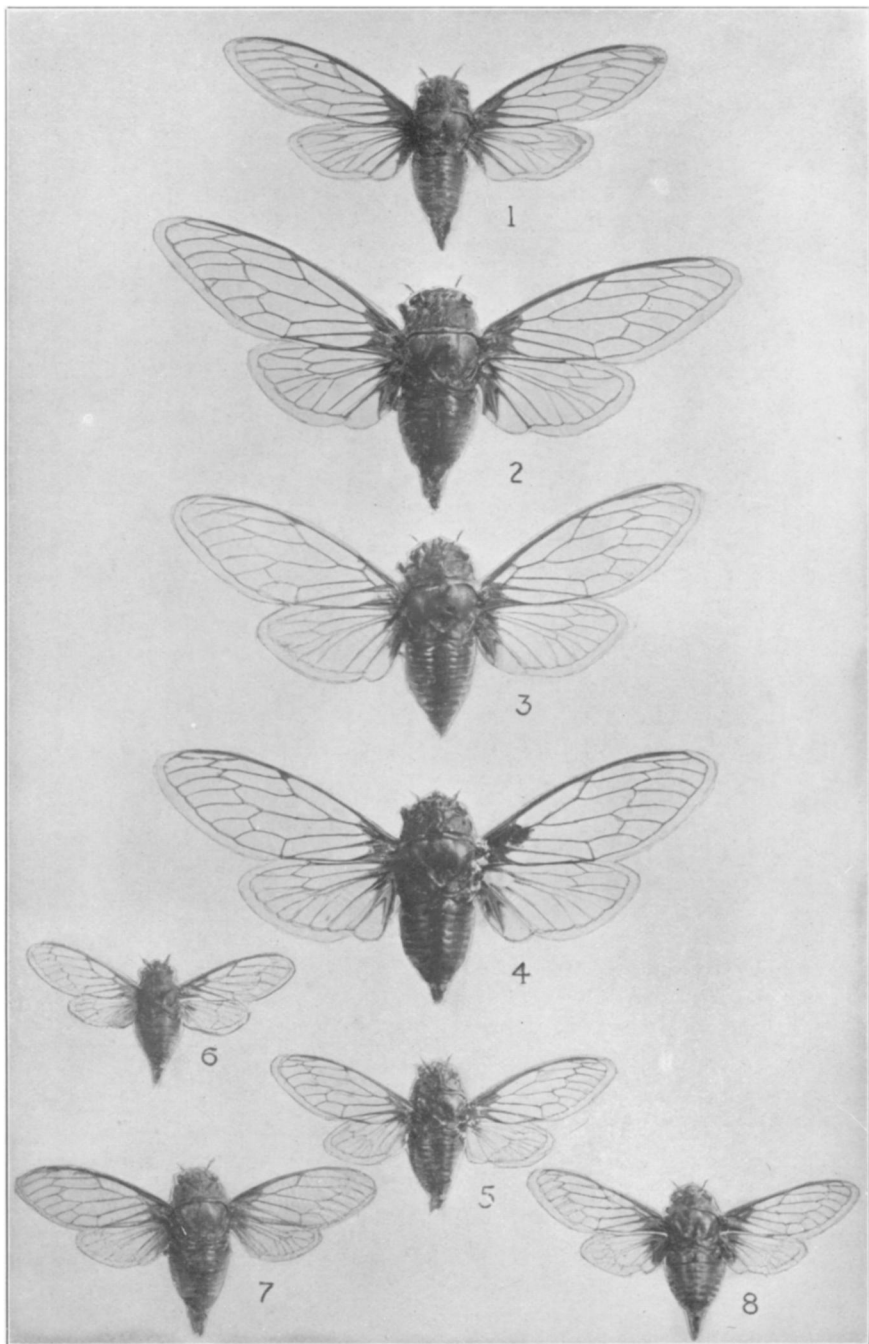
The type, in the collection of the Brooklyn Museum of Arts and Sciences is the only one I have seen. It was collected in 1904 by Messrs Doll & Engelhardt on sage brush. I take great pleasure in naming this species after Mr. Charles Schaeffer, of that Museum, who has always taken much interest in cicadas and with whom I have spent many pleasant days afield.

Okanagana fratercula new species.

Type, male, Bucks Valley, Iron Co., Utah.

A small black and orange species, a little larger than *O. synodica* and with clearer wings. It in fact closely resembles *O. schaefferi*, but while that is a very large *Okanagana* this is a very small one.

Length 20 mm.; to the tip of the wings 26 mm.; fore wings 8 by 20 mm. Head not quite as broad as the front margin of the pronotum; front considerably produced and on the upper surface margined by a well-defined elevated ridge, front sulcus narrow. Pronotum 3 by 8 mm.; the sides not parallel, the humeral angles rounded; sides sinuated toward the anterior angles which are prominent. Opercula oblique with the ends turned upward. Last ventral segment with the base about as long as the sides which gradually converge to the rounded end. Valve 3 mm. in length. Uncus when viewed in profile short, stout, not hooked; when viewed from above, broad at middle tapering to the end which shows a depression but is not notched. Wings transparent with veins beyond the middle fuscous. Costa of the fore wings yellowish edged with fuscous. All of the wings fuscous and orange at base; flaps orange, fuscous centrally. Head above black, with a yellow spot on each supra-antennal plate. Pronotum black, entirely bordered with yellow, and about one half of the median groove faintly yellow. Mesonotum black with hind margin irregularly bordered with light orange; X orange, with a black band across each anterior ridge followed by orange. Two small orange spots beyond. The dorsal light spots taken together are arranged in a semicircle. A yellow dash next the base of each fore wing. Metanotum with the posterior edge light orange. Dorsum of the abdomen black with all but the basal segment posteriorly edged with orange; uncus black with a triangular orange spot at base. Beneath, the valve pale, brown at tip and black at base, hind margins of all of the segments orange. The opercula black tipped with orange.



Cicadidæ.

Fore femora all black except the distal tips which are orange; middle and hind femora black except the orange-colored distal tips and inner surface. Rostrum black, orange at base; head black beneath, except the small orange spots about each antenna.

The type is in the collection of the Brooklyn Museum of Arts and Sciences and is the only one I have seen. It was collected in 1904 by Messrs. Doll and Engelhardt on sage brush. *Okanagana fratercula* seems to be a "little brother" to *O. Schaefferi*, and perhaps bears about the same relationship to it as does *Tibicina cassinii* to *T. septemdecim* in the eastern states.

EXPLANATION OF PLATE 3.

- Fig. 1. *Okanagana rubrovenosa*.
- Fig. 2. *Okanagana mariposa*.
- Fig. 3. *Okanagana hirsuta*.
- Fig. 4. *Okanagana schaefferi*.
- Fig. 5. *Okanagana fratercula*.
- Fig. 6. *Okanagana minuta*.
- Fig. 7. *Okanagana triangulata*.
- Fig. 8. *Okanagana mercedita*.

A PRELIMINARY REVIEW OF THE WEST COAST CICADIDÆ.

BY E. P. VAN DUZEE,

BERKELEY, CALIF.

The following key and the appended notes include all of the species of the Cicadidæ known to me to occur in California, Oregon and Washington. Thirty-four species or named varieties are recorded from these states and two from farther east are included to complete the review of the distinctively western genera, *Okanagana* and *Cacama*. Structural characters are very few in some of the genera, notably *Okanagana*, and I have been obliged to fall back upon color characters in the preparation of the key. The color and markings while variable in extent are quite constant in their general facies for each species. So far as I have collected them I have found that most